BULLETIN

OF THE INSTITUTE OF METALS

VOLUME 1 MARCH 1953 PART 19

INSTITUTE NEWS

Discussion on Liquid Metals

As announced in the programme of the Annual General Meeting (January *Bulletin*, pp. 133–135), the Metal Physics Committee is arranging a discussion on "Liquid Metals" on the morning of Thursday, 26 March, at the Park Lane Hotel, Piccadilly, London, W.1.

The Committee desires the discussion to be informal in character, and those taking part are therefore asked not to speak for more than five minutes. Apart from two introductory addresses, the reading of prepared contributions will not be permitted.

Dr. B. R. T. Frost, of the Atomic Energy Research Establishment, Harwell, and Dr. V. Kondic, of the Industrial Metallurgy Department, Birmingham University, have been invited to open the discussion with introductory surveys of the subject, and synopses of their contributions are being inserted in this issue of the *Journal*.

Election of Members

The following 8 Ordinary Members, 1 Junior Member, and 3 Student Members were elected on 15 January 1953:

As Ordinary Members

Brown, Arthur F., M.A., Ph.D., Lecturer, Natural Philosophy Department, University of Edinburgh.

Chettiar, P. S. N. S. Ambalavana, Managing Director, P. S. N. S. Ambalavana Chettiar and Co., Ltd., 260 Angappa Naicken Street, Madras 1, India.

Eisner, Frederick, Ph.D., Director, Electro-Chemical Research Laboratories, Ltd., 33 Knox Street, London, W.1.

Fairholme, Ian William Forbes, General Works Manager, Richard Johnson and Nephew, Ltd., Manchester 11.

Frenay, *Professor* Eugène L. J., Professeur de Métallurgie des Métaux autres que le Fer, Université de Liège, Belgium.

Pearce, Sidney Cecil, A.R.S.M., B.Sc., A.I.M., Metallurgist, H. J. Enthoven and Sons, Ltd., London, E.C.4.

Pietsch, *Professor* Erich, Direktor, Gmelin-Institut für anorganische Chemie und Grenzgebiete in der Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Altenauer Str. 24, Clausthal-Zellerfeld (Harz), Germany.

Polakowski, Natalis Horacy, Dipl.Ing., Ph.D., I.C.I. Research Fellow, University College, Swansea.

As Junior Member

Kirby, Patrick Charles, B.Sc., Metallurgist, J. Stone and Co. (Charlton), Ltd., London, S.E.7.

As Student Members

Atkinson, Raymond Frederick, Student of Metallurgy, University of Manchester.

Nield, Bernard John, B.Met., Research Student, Department of Metallurgy, University of Sheffield.

Smith, John Edward Martin, Assistant Foundry Metallurgist, Blackstone and Co., Ltd., Rutland Engineering Works, Stamford, Lincs.

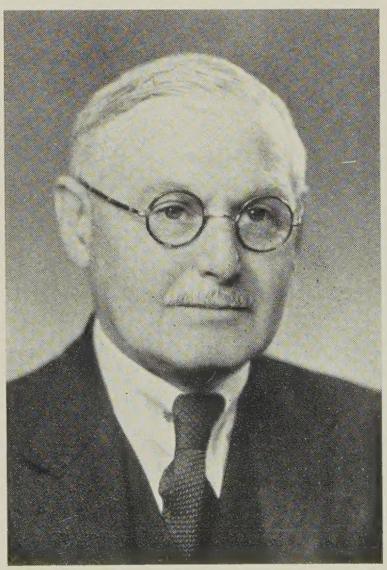
NEW OFFICERS

Below are given some biographical details of members who take office as President, Vice-Presidents, and Ordinary Members of Council at the Annual General Meeting on 24 March.

Professor F. C. Thompson

(President)

Frank Charles Thompson was educated at the Sheffield Royal Grammar School and King Edward VII School in the same city. Entering the Metallurgical Department of



the University of Sheffield in 1908, he graduated in 1911, being awarded the Mappin Medal. After spending a year taking further courses in pure science, he obtained a London

B.Sc. in 1912, and in that year was appointed to Professor Arnold's staff in the University of Sheffield, where he assisted with the teaching of metallography. During the 1914–18 war he served with the R.A.M.C. as an X-ray operator and as a part-time inspector of cupro-nickel for the Ministry of Munitions. For a short time he was with the Mechanical Warfare Department, in charge of specifications for tank armour.

In 1920 he was appointed Sorby Research Fellow and worked in the University of Sheffield on the etching properties of the carbides in alloy steels and the abnormal change points in iron below the carbon change point. After assisting as a part-time lecturer in the Metallurgical Department of the University of Manchester, he was appointed to the Chair of Metallurgy in 1921.

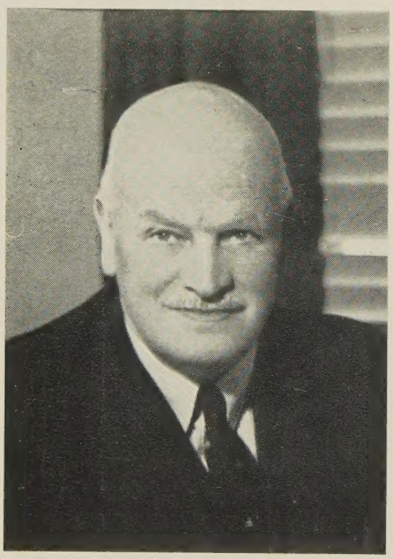
His research interests have centred mainly around problems dealing with stress effects in metals, particularly with the drawing of wire, and, in more recent years, with the measurement of creep and damping capacity. A number of papers on these subjects have been published in the *Journal*. He has served as President of the Institute of Welding.

He was elected a member of the Institute of Metals in 1917, and has served as an Ordinary Member of Council from 1924 to 1931 and again from 1946 to 1950, and as Vice-President from 1950 to 1953.

Major C. J. P. Ball
(Vice-President)

Charles James Prior Ball was born in 1893 at Cowes, Isle of Wight, and was educated at Charterhouse and University College, London.

During the 1914/18 War he was commissioned into the Royal Artillery, and took part in the landing at Cape Helles, Gallipoli, on 25 April 1915, with the 15th Brigade, R.H.A. Commanding first " B " Battery R.H.A., and later the 460th Howitzer Battery, he served with this Brigade in all its operations in Sinai, France, Belgium, and the march into



Germany. He was mentioned in Dispatches three times, and awarded the D.S.O. and M.C.

After serving in Germany with the British Army of Occupation and the Military Inter-Allied Commission of Control, he retired from the Army in June 1923 to join F. A. Hughes and Co., Ltd., as Managing Director, where he became closely identified with the development of the use of magnesium metal, both at home and abroad.

When F. A. Hughes and Co., Ltd., became a fully owned subsidiary of The Distillers Co., Ltd., in 1946, Major Ball was invited to join the Board of that Company, being appointed to the Management Committee in 1948. He is also Chairman and Managing Director of Magnesium Elektron, Ltd., and Chairman of British Resin Products, Ltd., as well as a Director of several other Companies in the D.C.L. Group, and of Sterling Metals, Ltd., Coventry.

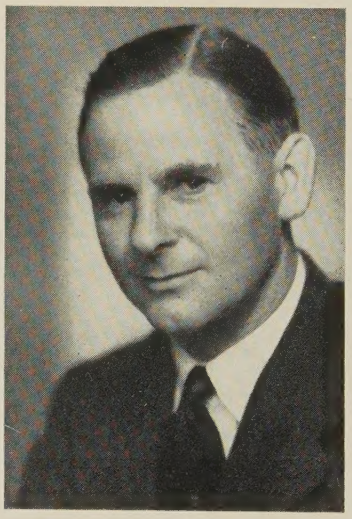
Major Ball's main interest in metals is with magnesium, and for the last thirty years he has been working to spread the use of this indigenous material. He is the author of a number of publications on magnesium and its alloys.

Major Ball was elected a Member of the Institute of Metals in 1937, and served as a Member of Council from 1945 to 1949, and as a Vice-President from 1949 to 1952. He was Chairman of the Finance and General Purposes Committee from 1948 to 1952.

He is a Fellow of the Royal Aeronautical Society.

Professor G. V. Raynor
(Vice-President)

Geoffrey Vincent Raynor was educated at Nottingham High School and Keble College, Oxford.



At Oxford he obtained a First Class in the Honour School of Natural Science (Chemistry) and qualified for the degree of B.Sc. in 1936. From 1936 to 1944 he carried out research work, mainly on the constitution of copper, magnesium, and aluminium alloys, in the Inorganic Chemistry Laboratory at Oxford, and obtained the degree of D.Phil. early in 1939. He received a Department of Scientific and Industrial Research Senior Research Award in 1938.

In 1944, Dr. Raynor was appointed to an Imperial Chemical Industries Research Fellowship in Metallurgy at Birmingham University and took up his duties there in January 1945. He continued with research on problems related to the constitution of alloys, and was appointed to a Senior Lectureship in Metallurgy in March 1947, and to the Readership in Theoretical Metallurgy in the autumn of the same year. He received a Beilby Memorial Award in 1947, and was awarded the degree of D.Sc. of Oxford University in the following year. His appointment as Professor of Metal Physics at Birmingham University was made in 1949, and he received the Institute's Rosenhain Medal in 1951.

For the academic year 1951–52, Dr. Raynor was Visiting Professor of Metallurgy at the Institute for the Study of Metals, Chicago University, and lectured there and at other metallurgical centres in the U.S.A. and Canada. He delivered the R. S. Williams Lectures at the Massachusetts Institute of Technology in 1951.

Professor Raynor has published several papers, in collaboration with colleagues and research students, on the theories and properties of alloys, and is the author of " An Introduction to the Electron Theory of Metals " (Institute of Metals Monograph and Report Series No. 4), which is in its second printing.

He is a Fellow of the Royal Institute of Chemistry, a Fellow of the Institute of Physics, an Associate of the Institution of Metallurgists, a Fellow of the Royal Society of Arts, and a Member of the Iron and Steel Institute. He joined the Institute of Metals in 1936, and has served as a Member of Council since 1949. He has also been a member of the Metal Physics Committee and of the Publication Committee.

Mr. W. A. Baker

(Ordinary Member of Council)

William Albert Baker joined the staff of the Assay Office, Royal Mint, London, as a student assistant, and graduated in metallurgy at the University of London as an external student in 1934.

Shortly afterwards he went as an investigator to the British Non-Ferrous Metals Research Association, where he was engaged mainly on problems connected with the melting, casting, and welding of non-ferrous metals, on which subjects he has published numerous papers in the Institute's *Journal* and elsewhere. He is now Research Manager of the British Non-Ferrous Metals Research Association.

He is a Member of Council and of several Committees of the Institution of Metallurgists, and represents the Institute of Metals on the Board of Governors of *Acta Metallurgica.*

Mr. J. C. Colquhoun

(Ordinary Member of Council)

James Clifton Colquhoun was born in 1893 in Clifton, Arizona, U.S.A., where his father, James Colquhoun, at that time was President of the Scottish-owned Arizona Copper Company, later acquired by the Phelps Dodge Corporation. His education at Trinity College, Glenalmond, and at Caius College, Cambridge, where he was reading for a Natural Science Tripos, was interrupted by World War I.

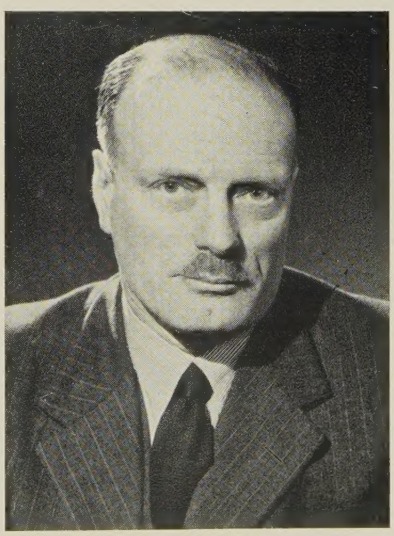
After that war and a brief spell back in the copper smelters of Arizona, for educational purposes, he studied metallurgy at the Royal School of Mines, London, until offered a position by Sir Cecil L. Budd, K.B.E., then Joint Managing Director of The British Metal Corporation. His business appointments since have been entirely with companies in which The British Metal Corporation held an interest, namely: Messrs. Vivian, Younger and Bond, Ltd., as Director; The Cornish Tin Smelting Co., Ltd., as Director and Local Manager; The Manganese Bronze and Brass Co., Ltd., of which he is the present Chairman and Managing Director; The Greenside Lead Mine on Lake Ullswater, as Director and Chairman for a time during the last war; and Lightalloys, Ltd., of which he is Chairman.

Mr. Colquhoun joined the Institute in 1924.

Mr. E. R. Gadd

(Ordinary Member of Council)

Ernest Reginald Gadd was born in 1902 and educated at Rutlish Science School. He entered the Royal Aircraft Establishment, Farnborough, in 1918, and there underwent



five years' training in metallurgy. In 1923 he joined the Bristol Aeroplane Co., Ltd., Engine Division, as assistant to the Chief Metallurgist. He succeeded to the post of Chief Metallurgist in 1930 and still holds the position.

During the last war Mr. Gadd served as an Aircraft Industry Representative on the Technical Advisory Committee of the Iron and Steel Control. He is a member of the Society of British Aircraft Constructors' Standing Committee on Materials, and is Deputy Chairman of its Metallic Materials Panel.

Mr. Gadd has been a member of the Institute since 1930, and has served on its Publication Committee for the last three years. He is also a Fellow of the Institution of Metallurgists.

The Hon. John Grimston
(Ordinary Member of Council)

John Grimston was born in 1912 and educated at Oundle and Christ Church, Oxford. In 1936 he joined Enfield Zinc Products, Ltd., and in 1938 Enfield Rolling Mills, Ltd., of which he is now Director and General Manager.

During the last war Mr. Grimston served as a pilot in Coastal Command. From 1943 to 1945 and again since 1950, he has represented the St. Albans division of Hertfordshire in Parliament.

Mr. Grimston has been a member of the Executive of the Cold Rolled Brass and Copper Association since 1946 and a member of the Executive of the British Non-Ferrous Metals Federation since 1950. He joined the Institute in 1949.

PERSONAL NOTES

Sir Clive Baillieu received a barony in the New Year Honours List.

Professor P. G. Bastien has been awarded the V. Noury Prize of the Institut de France for his contributions to metallographic research.

Mr. P. Brock has been awarded the Ph.D. degree of Sheffield University and is now on the staff of the British Non-Ferrous Metals Research Association.

Mr. R. D. Carter has left the Plessey Co., Ltd., to take up an appointment with British Insulated Callender's Cables, Ltd., Shepherd's Bush, London.

Mr. G. T. Colegate has been transferred from the Shell Petroleum Co., Ltd., to Shell Venezuelan Oil Concessions, Ltd., and has recently left England for Venezuela.

Mr. D. K. Coutts has been appointed Assistant Manager of the Technical Office of The Mond Nickel Co., Ltd., in Bombay.

Mr. B. G. Davies has been awarded the Ph.D. degree of the University of Wales.

Professor E. Houdremont has been awarded the honorary degree of Dr.Ing. of the Technische Hochschule, Berlin-Charlottenburg.

Dr. D. E. R. Hughes has left Tube Investments, Ltd., to take an appointment in the G.K.N. Group Research Laboratories, Wolverhampton.

Mr. William E. Kuhn has left Titanium Alloy Manufacturing Co. and is now with The Carborundum Metals Co., Niagara Falls, N.Y.

Dr. A. Latin has left British Insulated Callender's Cables, Ltd., to take up the post of Head of the Department of Metallurgy and Chemistry at the National Coal Board Central Research Department II, Isleworth, Middlesex.

Professor G. Masing has been made an honorary doctor (Dr.Ing.e.h.) of the Technische Hochschule, Berlin-Charlottenburg.

Mr. N. H. Moseley has left The Mint Birmingham, Ltd., to take up the position of Metallurgist and Foundry Manager to Albert G. Sims, Ltd., 241 Roden Street, West Melbourne C3, Vic., Australia.

Mr. G. Murfitt has been appointed a Director of Metals and Methods, Ltd., Langley, Bucks.

Mr. F. R. N. Nabarro has been awarded the degree of D.Sc. of Birmingham University.

Mr. L. Powell has been transferred from the Alkali Division to the Nobel Division of Imperial Chemical Industries, Ltd., to take charge of a newly formed section dealing with materials of construction. His address is now Research Department, Imperial Chemical Industries, Ltd., Nobel Division, Stevenston, Ayrshire.

Mr. K. Sachs has left The Mond Nickel Co., Ltd., and joined the staff of the G.K.N. Group Research Laboratory, Wolverhampton.

Mr. G. Slattery has left the A.E.I. Research Laboratories, Aldermaston, and taken up an appointment as Scientific Officer in the Ministry of Supply, Division of Atomic Energy, Springfields, near Preston.

Mr. C. B. Snodgrass, General Manager of Fusarc, Ltd., Gateshead, has been appointed Director and General Manager of the Company.

Mr. J. E. Srawley has recently joined the staff of the British Columbia Research Council, Vancouver.

Mr. P. H. Tortise has left James Booth and Co., Ltd., to take up an appointment as Assistant Works Chemist with Denbro, Ltd., Handsworth, Birmingham.

Dr. R. F. Tylecote has been appointed a Lecturer in Metallurgy at King's College, Newcastle-upon-Tyne.

Mr. J. Wilkinson, Director and Chief Metallurgist of The Yorkshire Copper Works, Ltd., has been awarded an honorary M.Sc. degree by Leeds University.

Professor A. B. Winterbottom, formerly at the Metallurgisk Institutt, Norges Tekniske Høgskole, Trondheim, has accepted a post in Pakistan under the auspices of U.N.E.S.C.O. and his address is now: Department of Metallurgy, University of Dacca, Dacca, East Pakistan.

Death

The Editor regrets to announce the death of:

Sir James Weir French on 14 January, formerly Chairman of Barr and Stroud, Ltd., Glasgow. He had been a member of the Institute since 1939.

LETTER TO THE EDITOR

Stress-Cracking of Copper by Mercury

The view seems to be generally held that whereas stressed brass is susceptible to intercrystalline cracking by mercury, copper is immune. For example, Edmunds[1] states that copper is immune to mercury and ammonia stress-cracking. Robertson[2] is more positive. He says: "Copper is not susceptible to mercury cracking, because the equilibrium dihedral angle formed at the grain boundaries in contact with mercury is such that penetration is impossible".

Table I.—*Influence of Rate of Strain and Mercury on the Mechanical Properties of Tough-Pitch Copper (Mean Grain Dia. 0·03 mm.).*

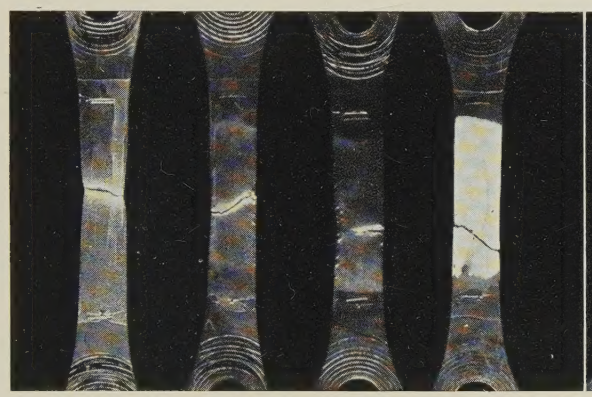
Rate of Strain, %/hr.	Max. Stress, lb./in.²	Elongation % on 1 in. (at fracture or cracking)
0·2	28,000	34·5
40	28,600	36
1000	31,500	44
40 (without Hg)	28,800	50

Table II.—*Influence of Rate of Strain and Mercury on the Mechanical Properties of O.F.H.C. Copper (Mean Grain Dia. 0·10 mm.).*

Rate of Strain, %/hr.	Max. Stress, lb./in.²	Elongation % on 1 in. (at fracture or cracking)
0·2	27,000	20
40	25,400	22
1000	29,000	30
40 (without Hg)	27,600	42

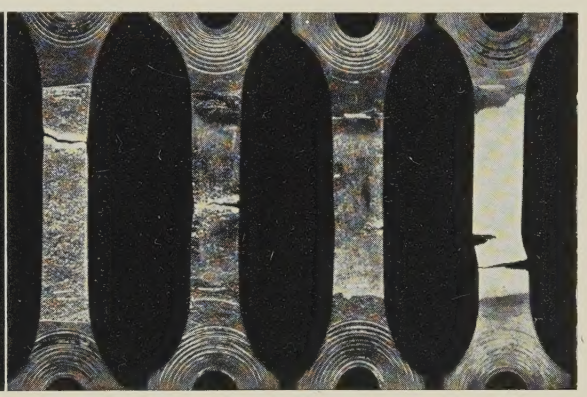
"dry". At the end of the experiment the existence of a second solid phase on the surface was confirmed by X-ray diffraction.

A control test without mercury was carried out at the intermediate strain rate on each type of copper. All specimens were annealed after machining to size. The grain-size was measured by counting all grains across the test-piece on two traverses and so obtaining the mean diameter.



(*a*) (*b*) (*c*) (*d*)

Fig. 1.—Tough-pitch Copper.



(*a*) (*b*) (*c*) (*d*)

Fig. 2.—O.F.H.C. Copper.

Without mercury (*a*); with mercury, strained at 1000 (*b*), 40 (*c*), and 0·2 (*d*) %/hr.

During an investigation of the influence of mercury on 70:30 brass subjected to varying rates of strain, it was decided to carry out some check experiments on copper.

Two types of copper were used: O.F.H.C. and tough pitch. They were subjected to approximately constant rates of tensile strain of 0·2, 40, and 1000%/hr. at room temperature. Mercury was applied to the electropolished surface by rubbing with cotton-wool soaked in a saturated solution of mercuric chloride, followed by washing in water. This produced a film of metallic mercury sufficiently thin to evaporate within 24 hr. Consequently, with the lowest strain rate it was necessary to supplement this by the addition of liquid mercury. Under the slow straining conditions imposed, this added mercury combined with the copper, giving a solid phase. More liquid was added whenever the surface appeared

The results are shown in Tables I and II, and the test-pieces after fracture are shown in Figs. 1 and 2. The bright appearance of the test-pieces strained at the lowest rate is due to the presence of a mercury–copper solid phase.

Taking the control test as standard, it will be noted that the maximum stress to fracture is not significantly affected by the presence of mercury. The ductility, as measured by elongation, is, however, appreciably lowered, the more so the lower the rate of strain. A check test with O.F.H.C. copper showed that the properties (without mercury) were unaffected by strain rate alone.

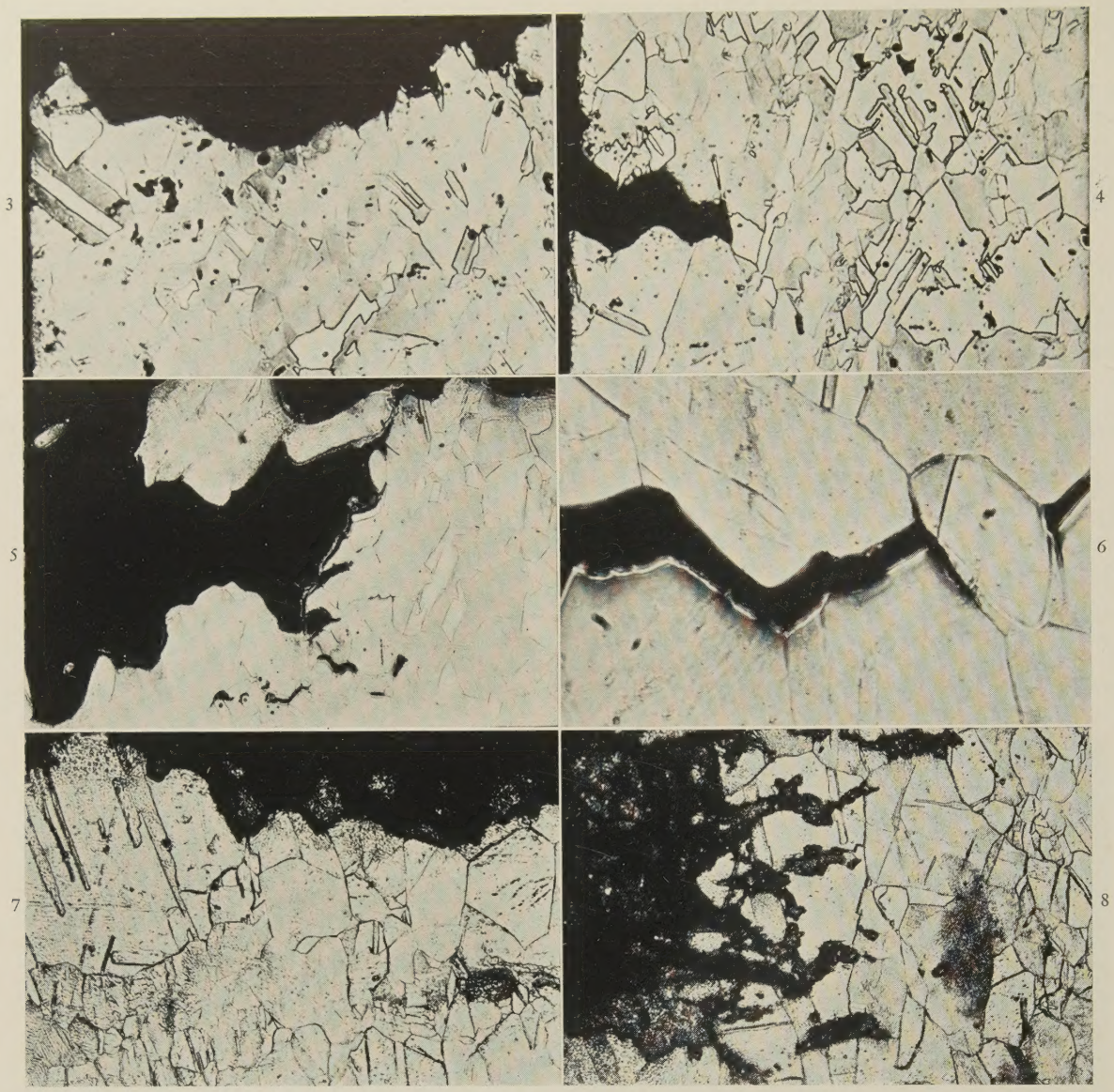


FIG. 3.—Tough-Pitch Copper. Fracture edge after straining at 40%/hr. × 200.
FIG. 4.—Tough-Pitch Copper. Edge crack in same piece. × 200.
FIG. 5.—O.F.H.C. Copper. Fracture edge after straining at 40%/hr. × 100.
FIG. 6.—O.F.H.C. Copper. Same piece, internal crack. × 500.
FIG. 7.—O.F.H.C. Copper. Fracture edge after straining at 0·2%/hr. × 100.
FIG. 8.—O.F.H.C. Copper. End of same fracture, showing transcrystalline penetration. × 100.

The lower elongation shown by the O.F.H.C. copper is probably due to the larger grain-size—0·10 mm. as compared with 0·03 mm. for the tough-pitch copper.

Micro-examination showed that all fractures in the presence of mercury were intercrystalline. This feature is illustrated in Figs. 3–8. It will be seen in Fig. 8, which is the end of one of the two main fractures, that transcrystalline attack has also occurred.

In view of these results, the previous views concerning the immunity of copper from mercury stress-cracking must be modified. There is a great difference in the degree of susceptibility of copper as compared with 70 : 30 brass. It is possible that this difference and the fact that a stress very close to the breaking stress is needed to cause the effect, is the reason why this observation was not made earlier.

J. NEILL GREENWOOD.
Research Professor of Metallurgy

Baillieu Laboratory,
University of Melbourne,
Australia.

REFERENCES

1. G. Edmunds, *Symposium on Stress-Corrosion Cracking of Metals, (A.S.T.M.-A.I.M.E.)*, **1944**, 87.
2. W. D. Robertson, *Trans. Amer. Inst. Min. Met. Eng.*, 1951, **191**, 1190.

NEWS OF LOCAL SECTIONS AND ASSOCIATED SOCIETIES

Sheffield Local Section

At a joint meeting of the Section with the Sheffield and North-East Branch of the Institute of Metal Finishing on 12 December, Dr. G. L. J. BAILEY, Deputy Research Manager of the British Non-Ferrous Metals Research Association, gave a lecture on:

The Mechanism of Adhesion of Electrodeposits upon Aluminium

After giving reasons why plating upon aluminium is likely to prove of increasing commercial importance, the lecturer reviewed methods of plating upon aluminium and theories dealing with the adhesion of the deposits. He went on to illustrate the effects of low and high nucleation density upon the adhesion of deposits applied using the immersion zincate method, and showed how optimum adhesion could be obtained.

In the discussion, speakers referred to factors influencing the density of nucleation and affecting the area of intimate contact between the basis metal and the growing crystals of the electrodeposit.

South Wales Local Section

At a meeting of the Section held on 13 January 1953, in the Metallurgical Department of University College, Swansea, at 6.30 p.m., Major P. L. TEED, Deputy Chief of Research and Development, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge, delivered a lecture on "Some Metallurgical Problems Imposed by Stratospheric Flight". A synopsis of this lecture will be found on p. 80 of the May 1952, issue of the *Bulletin*.

At a meeting held at University College, Swansea, on 10 February, Dr. B. A. BILBY spoke on:

Dislocations in Crystals

The lecturer said that the slip of crystals during plastic deformation occurred in crystallographic directions on crystallographic planes. The current theory of this process postulated that the slip occurred first in local regions, whose boundaries then moved across the slip plane as the slip spread. These boundaries, separating regions which had slipped from those which had not, were "dislocations".

There were important differences between the properties of dislocation lines which lay parallel to the direction of slip (screw dislocations) and the properties of those which lay perpendicular to the direction of slip (edge dislocations). A dislocation line was the source of an elastic stress field in the lattice; it also had a line tension which tended to make it as short as possible. These properties formed the basis of quantitative theories of the behaviour under stress of crystals containing dislocations. Many results of these theories could be illustrated qualitatively with the aid of a simple model of a crystal lattice into which dislocation lines could be introduced.

The dislocation theory enabled a qualitative account of many of the mechanical properties of metals to be given, and there were several phenomena which were not easily explained without it. Recently direct evidence for the existence of dislocations had arisen from a study of spiral steps on the surfaces of growing crystals. Similar evidence for local slip had come from studies with the high-speed camera of the development of slip lines.

NEWS OF KINDRED SOCIETIES

Australian Institute of Metals

The 1953 Annual Meeting and Congress of the Australian Institute of Metals will be held in Brisbane from 25 to 29 May. Besides technical sessions, the programme will include visits to various industries in Queensland. Any members of the Institute of Metals who are in Australia at the time are warmly invited to the meeting.

Institution of Mechanical Engineers

The Council of the Institution of Mechanical Engineers is arranging on Friday, 6 March 1953, a one-day Conference, at which a series of papers on Marine Steam Turbines will be presented. The authors of these papers are Dr. T. W. F. Brown and several of his colleagues at the Parsons and Marine Engineering Turbine Research and Development Association, and the papers will review the work which that Association has been and is now doing.

The Conference will take place in the Institution Building at Storey's Gate, London, S.W.1, and there will be three sessions, Morning, Afternoon, and Evening, the last being devoted to a general discussion of the papers presented at the earlier sessions.

Admission to the Conference will be by ticket only. Arrangements are being made for a buffet lunch to be available in the Institution Building, for those who have applied in advance for tickets, the charge being 6*s*. 0*d*. per head. Refreshments will be served, without charge, to those attending, at 4.45 p.m.

A cordial invitation has been issued to members of the Institute of Metals to attend. Advance copies of the papers will be available nearer the date of the Conference, and will be forwarded to those persons taking part.

The Physical Society

The Spring Provincial Meeting of the Physical Society will be held in the Department of Physics, The University, Leeds 2, on Monday, Tuesday, and Wednesday, 30, 31 March, and 1 April 1953. The meeting will be on:

Aspects of Solid-State Physics

and will be divided into three sessions: (1) Analysis of Magnetization Curves; (2) Band Theory of Metals; (3) Ferroelectricity and Luminescence.

Papers by the following will be delivered: A. F. Devonshire (Bristol University); E. W. Elcock, J. Ewles, F. E. Hoare, K. Hunt, P. Rhodes, E. C. Stoner, and R. S. Tebble (all of Leeds University); H. Jones and E. P. Wohlfarth (both from Imperial College, London University); L. F. Bates (Nottingham University); E. E. Schneider (King's College, Newcastle-upon-Tyne); W. Sucksmith (Sheffield University).

If sufficient applications are received, a coach tour to Bolton Abbey and Kirkstall Abbey will be arranged on Wednesday, 1 April.

Visitors wishing to attend this meeting should apply to the offices of the Physical Society, 1 Lowther Gardens, Prince Consort Road, London, S.W.7, for further particulars. Closing date for applications is Monday, 9 March 1953. Non-members are welcomed.

DIARY

The Institute

23 March. Forty-third Annual May Lecture: "The Present and Future Requirements of the Chemical Engineer", by Sir Christopher Hinton. Non-members will be welcome; tickets of admission are not required. (Royal Institution, Albermarle Street, London, W.1, at 6.0 p.m.)

24–26 March. Spring Meeting. For full details, see January issue of the *Bulletin*, pp. 133–135.

Local Sections and Associated Societies

9 March. Scottish Local Section. Details to be announced later. (Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.)

12 March. Liverpool Metallurgical Society. "Use of Aluminium in Shipbuilding and Structural Engineering", by Dr. E. G. West. (Liverpool Engineering Society, The Temple, Dale Street, Liverpool, at 7.0 p.m.)

17 March. South Wales Local Section. Annual General Meeting, followed by films of metallurgical interest. (University College, Metallurgy Department, Singleton Park, Swansea, at 6.30 p.m.)

18 March. Manchester Metallurgical Society. Visit to Thomas Bolton and Sons, Ltd., Froghall.

20 March. North-East Metallurgical Society. "The Role of Metallurgy in Atomic Energy", by Dr. H. M. Finniston. (William Newton School, Norton, Co. Durham, at 7.15 p.m.)

31 March. Oxford Local Section. Annual General Meeting, followed by discussion of Papers to be discussed at the Institute's Annual General Meeting. (Black Hall, St. Giles, Oxford, at 7.0 p.m.)

2 April. Birmingham Local Section. Annual General Meeting and Chairman's Address. (James Watt Memorial Institute, Great Charles Street, Birmingham 3, at 6.30 p.m.)

2 April. Leeds Metallurgical Society. "Recent Advances in Electrodeposition of Metals and Alloys", by Dr. J. W. Cuthbertson. (Chemistry Department, The University, Leeds 2, at 7.15 p.m.)

2 April. London Local Section. Annual General Meeting, followed by an Open Discussion. (4 Grosvenor Gardens, London, S.W.1, at 6.30 p.m.)

9 April. Liverpool Metallurgical Society. Annual General Meeting, followed by "The Basic Processes Involved in the Tempering of Plain Carbon and Low-Alloy Steels", by Dr. W. S. Owen. (Liverpool Engineering Society, The Temple, Dale Street, Liverpool, at 7.0 p.m.)

Other Societies

12 March. Institute of Metal Finishing, North-West Branch. "The Plating of Aluminium", by R. Ore. (Engineers' Club, Albert Square, Manchester, at 7.30 p.m.)

16 March. Institute of Metal Finishing, London Branch. "Detergents, with Special Reference to Metal Finishing", by F. H. Bell. (Northampton Polytechnic, St. John Street, London, E.C.1, at 6.0 p.m.)

18 March. Institute of Welding, North London Branch. "Hard Facing and Reclamation of Worn Parts", by M. Riddihough. (South-West Essex Technical College, Walthamstow, at 7.30 p.m.)

19 March. Institution of Mining and Metallurgy. General Meeting. (Rooms of the Geological Society, Burlington House, Piccadilly, London, W.1, at 5.0 p.m.)

20 March. Institute of Physics, Industrial Radiology Group. "Impressions of Non-Destructive Testing in North America", by R. Bentley. (The Institute of Physics, 47 Belgrave Square, London, S.W.1, at 6.30 p.m.)

27 March. Institute of Metal Finishing, Sheffield and N.E. Branch. "Preparation and Deposition of Silver upon Ferrous and Non-Ferrous Metals", by A. R. Knowlson. (Grand Hotel (Fitzwilliam Room), Sheffield, at 7.30 p.m.)

27 March. Manchester Association of Engineers. "Friction between Solid Bodies", by Dr. R. Schnurmann. (Engineers' Club, Albert Square, Manchester 2, at 6.45 p.m.)

27 March. Royal Aeronautical Society. Full-Day Discussion on Fatigue. (Chemistry Lecture Theatre, University College, Gower Street, London, W.C.1.)

27 March. Society of Chemical Industry, Corrosion Group. All-Day Symposium on "Corrosion Inhibitors". Joint Meeting with the Society of Chemical Industry, Manchester Section, the Royal Institute of Chemistry, the Chemical Society, and the Institute of Petroleum. (Chemistry Lecture Theatre, Manchester University.)

30 and 31 March. Physical Society. "Aspects of Solid-State Physics". (Department of Physics, The University, Leeds 2.) For details see p. 179.

APPOINTMENTS VACANT